Poster-1-14

Theoretical framework for polarization dependent magneto-absorption in (anti)ferromagnetic materials

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Microscopic structure of (anti)ferromagnets (A)FMs can be described using Heisenberg spin Hamiltonians, with corresponding parameters such as spin-spin exchange couplings or anisotropies. Experimental determination of these parameters typically involves measurement of magnetic excitation spectra either via inelastic neutron scattering(INS) or (THz)GHz magneto-absorption. While the absorption experiments provide greater accuracy than INS, they are limited to the Γ-point ($k = 0$) only, making the inclusion of external magnetic field H vital to extend the available dataset. Another avenue, which remains largely unexplored in the present literature, is the polarization control of the applied (THz)GHz field. This, together with recent measurements as in [1] (Fig. 6), motivate our theoretical study of the phenomena.

We utilize both numerical spin dynamics model and analytical description of the linear response regime in the linear spin wave theory(LSWT) framework to determine the circularly polarization(CP) dependent absorption coefficient and derive expressions connecting microscopic parameters of simple FMs and AFMs to features of resulting measurable magneto-absorption curves.

[1] J. Dzian, P. Kubaščík, S. Tázlaru et al., PRB 112, 024433 (2025).